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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/772,740	02/05/2004	Yonhua Tzeng	220101-1011	5635

28960 7590 05/12/2008
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EXAMINER	
STOUFFER, KELLY M	

ART UNIT	PAPER NUMBER
1792	

MAIL DATE	DELIVERY MODE
05/12/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/772,740	TZENG, YONHUA	
	Examiner	Art Unit	
	KELLY STOUFFER	1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *18 March 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-14 and 18-26* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-14 and 18-26* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

Applicant's arguments filed 18 March 2008 have been fully considered but they are not persuasive. The applicant argues that there is no motivation to combine Shinya (or SEL as indicated below) and Pryor because Pryor includes hydrogen in the mixture while Shinya avoids using hydrogen, hence there is no reasonable expectation of success. However, there is a reasonable expectation of success that the precursor mixtures of Pryor will achieve the result in Shinya without hydrogen, as Shinya teaches that one may eliminate hydrogen from the reaction mixture by using alcohols (such as those suggested by Pryor) as a reactant gas (see Means for Solving the Problem section of Shinya). Shinya teaches that one of ordinary skill in the art would want to remove hydrogen from the mixture because hydrogen is expensive, explosive, causes exfoliation, and does not compound a diamond film properly (See the Technical Problem section of Shinya). Therefore, it is obvious to utilize a mixed methanol / ethanol liquid precursor mixture in the process of Shinya as taught by Pryor with the reasonable expectation of success and obtaining similar results (i.e., successfully depositing a diamond film on a substrate by using liquid alcohol-based precursors **without a carrier gas, specifically hydrogen**, as desired by Shinya) when compared to utilizing either methanol or ethanol precursors individually. Pryor is simply used by the examiner to show that using a mixed methanol/ethanol solution instead of just methanol is beneficial to the process and will obtain similar results. The examiner does

not suggest that the entire precursor mixture of Pryor that includes hydrogen is substituted into Shinya and vice versa. It is also obvious that one of ordinary skill in the art would want to avoid using hydrogen as taught by Shinya for the reasons listed above. The claim would have been obvious because the substitution of one known element (methanol) for another (methanol/ethanol) would have yielded predictable results to one of ordinary skill in the art at the time of the invention. See *KSR International Co. V. Teleflex Inc.,* 550 U.S.--, 82 USPQ2d 1385 (2007). Further, it is noted by the examiner that one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). As SEL clearly shows a reasonable expectation for success in using a high percentage of alcohol to make diamond, further evidence would be needed from the applicant to prove the allegations of inoperability in the instant arguments.

In response to the applicants other arguments against the other references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). As was discussed in the previous action, combining Shinya with Pryor and other references cures these deficiencies noted in the instant arguments. “Substantially free of water” is taught by SEL as the liquid precursor is 100% alcohol (paragraph [0010]), and none of the examples of diamond deposition

taught by SEL include any water in the liquid precursor material (paragraphs [0013] – [0020]). To show criticality of the claimed pressure ranges as the applicant argues, the claim must be commensurate in scope with evidence showing its importance. As for supplying liquid precursor without interrupting formation of diamond, Versteeg does indeed teach this limitation as the applicant cites. As for the limitation of "without seeding" a preamble is generally not accorded any patentable weight where the body of the claim does not depend on the preamble for completeness but, instead, the process steps or structural limitations are able to stand alone – which the process steps of claim 26 certainly can. This limitation fits this description as far as it is described in the specification. See *In re Hirao*, 535 F.2d 67, 190 USPQ 15 (CCPA 1976) and *Kropa v. Robie*, 187 F.2d 150, 152, 88 USPQ 478, 481 (CCPA 1951).

In response to applicant's argument that neither Shinya or Pryor or the other combinations relay the benefits the inventor found by using the precursor mixture, the fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985).

Therefore, in view of the aforementioned arguments, the rejections of the previous office action are maintained and repeated here.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-14 and 18-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Semiconductor Energy Lab (JP 05-097583 A), referred to hereinafter as SEL, in view of Pryor (USPN 5,236,545) and either Versteeg et al. (USPN 5,451,260) or Robson et al. (USPN 5,874,014).

SEL teaches a method for forming diamond crystals or a diamond film (Abstract), the method comprising disposing a substrate "4" in a reaction chamber (paragraph [0011] and Figures 1 and 3), introducing, in the absence of a gas stream, a precursor containing methanol or ethanol (i.e., a carbon and oxygen containing compound having a carbon to oxygen ratio greater than one) into an inlet of the reaction chamber (Figures 1 and 3, Abstract, and paragraphs [0010] – [0012]), vaporizing the liquid precursor (paragraph [0012]), and subjecting the vaporized precursor, in the absence of a carrier gas, to a plasma under conditions effective to excite the precursor and promote diamond growth on the substrate (paragraphs [0010] – [0020]). Further, the liquid precursor taught by SEL is 100% alcohol (paragraph [0010]), and none of the examples of diamond deposition taught by SEL include any water in the liquid precursor material (paragraphs [0013] – [0020]). As such, the liquid precursor of SEL is substantially free of water. In addition, although SEL uses the term "excited" as opposed to

"disassociated" to refer to the vaporized precursor material (paragraph [0011]), a microwave-based plasma is formed (paragraph [0011]) and therefore the vaporized precursor material is inherently disassociated (i.e., because a plasma inherently contains disassociated material species). SEL does not explicitly teach that the liquid precursor contains methanol and at least one carbon and oxygen containing compound having a carbon to oxygen ratio greater than one. Specifically, SEL teaches liquid precursors such as methanol and ethanol (Abstract and paragraph [0011]) and that the diamond can be deposited "with 100% of alcohols" (paragraph [0010]), but does not explicitly teach using a combination of methanol and another compound having a carbon to oxygen ratio greater than one as the liquid precursor. However, Pryor teaches that, in the art of depositing diamond films by microwave plasma CVD process (i.e., a process analogous to that of SEL), carbon-containing precursors such as methanol or ethanol can be utilized, as well as mixtures thereof (Col.9, lines 3 – 20). In other words, Pryor teaches the functional equivalence of individual methanol and ethanol precursors (e.g., as suggested by SEL) and combined methanol / ethanol precursors for depositing diamond in a plasma enhanced CVD process. Therefore, it would have been obvious at the time the invention was made to a person having ordinary skill in the art to utilize a mixed methanol / ethanol liquid precursor mixture in the process of SEL with the reasonable expectation of success and obtaining similar results (i.e., successfully depositing a diamond film on a substrate by using liquid alcohol-based precursors without a carrier gas, specifically hydrogen, as desired by SEL) when compared to utilizing either methanol or ethanol precursors individually. This feature would have

been obvious because the substitution of one known element (methanol) for another (methanol/ethanol) would have yielded predictable results to one of ordinary skill in the art at the time of the invention. See *KSR International Co. V. Teleflex Inc.,* 550 U.S.--, 82 USPQ2d 1385 (2007).

Additionally, with respect to the independent claims, SEL does not explicitly teach that the alcohol-based liquid precursor is a liquid when introduced into the inlet of the reaction chamber. Specifically, SEL teaches that vapor of the liquid precursor is introduced into the reaction chamber (paragraphs [0011] and [0012]). Versteeg et al. teach a liquid delivery system and method for the CVD of films in a reaction chamber (Abstract). Versteeg et al. also teach that any liquid organic precursor solution can be used in their liquid delivery system (Col.2, lines 14 – 15) and that a wide variety of films can be deposited (Col.5, lines 50 – 56). The liquid delivery system can be utilized in a microwave plasma enhanced deposition processes (i.e., a process analogous to that of SEL and Pryor) (Col.2, lines 66 – 68, and Col.3, lines 1 – 2). In this system, a mist of the liquid precursor is introduced into an inlet of the reaction chamber, after which the liquid precursor is vaporized and comes into contact with a substrate to deposit a film (Col.2, lines 3 – 13 and 44 – 68, and Col.3, lines 1 – 14). Versteeg discloses in column 2 lines 3-13 that the liquid precursor enters a metering valve as a liquid then is atomized and consequently vaporized during entry in the reaction chamber inlet to generate vaporized precursor. Versteeg et al. teach that this method of precursor delivery is extremely simple and economical, and it avoids the need for cumbersome mass flow controllers, carrier gases, and heated sources and lines (Col.5, lines 36 – 44). It would have been

obvious to one of ordinary skill in the art to utilize the liquid delivery system and method of Versteeg et al. to introduce the alcohol-based liquid precursor of SEL (i.e., to introduce the precursor as a liquid into the inlet of the reaction chamber) with the reasonable expectation of (1) success, as the precursors of SEL are alcohols (i.e., organic liquids), and Versteeg et al. teach that any liquid organic precursor solution can be used in their liquid delivery system and that the system can be utilized in a microwave plasma enhanced deposition processes (i.e., such as the one of SEL), and (2) obtaining the benefits of using the aforementioned liquid delivery system, such as its simplicity, economic nature, and avoidance of cumbersome mass flow controllers, carrier gases, and heated sources and lines. Robson et al. teach that, in the process of depositing diamond from precursors such as ethanol, methanol, and isopropanol, the precursors are generally gaseous or vaporize to a gaseous form upon introduction into the deposition chamber (Col.13, lines 15 – 26). Therefore, it would have been obvious to one of ordinary skill in the art to introduce the liquid precursors of SEL into an inlet of the reaction chamber of SEL and subsequently vaporize the precursors (i.e., as opposed to first vaporizing the precursors and then introducing the vapor, as suggested by SEL) with the reasonable expectation of (1) success, as Robson et al. teach that such as process was known in the art at the time of the applicant's invention, and (2) obtaining similar results (i.e., successfully depositing diamond from a liquid precursor, regardless of whether the liquid precursor is vaporized prior to introduction into an inlet of a deposition chamber or after introduction into the inlet).

Regarding the limitation that the reaction chamber is in a "non-magnetic microwave field plasma system", the combination of SEL, Pryor, and either Versteeg et al. or Robson et al. teaches these limitations. Specifically, SEL teaches that a diamond film according to their invention can be formed by using microwave plasma CVD system that does not use a magnetic field (Figure 1 and paragraphs [0019] – [0022]). SEL teaches that this system has an advantage, namely that the equipment is very simple and cheap because no magnetic field is used (paragraph [0019]). Therefore, it would have been obvious to one of ordinary skill in the art to utilize a "non-magnetic microwave field plasma system" as taught by SEL in the diamond deposition process of the combination of SEL, Pryor, and either Versteeg et al. or Robson et al. with the reasonable expectation of (1) success, as both SEL and Pryor teach that non-magnetic field microwave plasma systems can be successfully utilized to deposit diamond, and (2) obtaining the benefits of using a non-magnetic field system as opposed to a system that uses a magnetic field, such as the ability to use equipment that is very simple and cheap, as taught by SEL.

SEL does not explicitly teach the applicant's claimed pressure ranges as required by the independent claims 1 and 10 and claims 3-4 and 11-13. However, it would have been obvious to one of ordinary skill in the art to determine the operating pressure, through routine experimentation, absence evidence of criticality.

As to claims 2 and 14, the carrier gas is not hydrogen (Abstract and paragraphs [0010] and [0023] of SEL).

As to claims 5-8 and 11-13, since Pryor teaches the functional equivalence of methanol and ethanol, to use any relative amount of methanol to ethanol would have been obvious at the time the invention was made to a person having ordinary skill in the art, absence evidence of criticality. For the claimed pressure range, see the discussion above.

As to claims 9, and 18-20, the methanol is supplemented with one or more carbon and oxygen containing compounds containing carbon, hydrogen, and oxygen with an atomic ratio of carbon to oxygen greater than one, preferably ethanol, isopropanol, acetone, or combinations thereof (shown above).

As to claim 21, the diamond film of SEL is formed directly on the substrate without seeding (see Examples of SEL).

As to claim 22, the substrate comprises a sheet or wafer of silicon, copper, aluminum, molybdenum, or alloys thereof (Examples 1 – 3 of SEL).

As to claims 23 and 25, the metering system of Versteeg is temperature and pressure controlled with the use of a microprocessor (columns 3-4 lines 47-8).

As to claim 24, Versteeg discloses mixing precursor solution and stores it as show in the figures without a change from atmospheric pressure, additionally the nozzles meter the precursor and replenish the supply to the reaction chamber during formation of the diamond film without interrupting the formation (columns 2-3 lines 44-24).

As to claim 26, the various features of this claim are taught in reference to the independent claims and claim 24 as discussed above. The "without seeding" limitation is obvious when reading over the entire document of SEL, and in addition, this limitation

has not been given patentable weight because the recitation occurs in the preamble. A preamble is generally not accorded any patentable weight where the body of the claim does not depend on the preamble for completeness but, instead, the process steps or structural limitations are able to stand alone. This limitation fits this description as far as it is described in the specification. See *In re Hirao*, 535 F.2d 67, 190 USPQ 15 (CCPA 1976) and *Kropa v. Robie*, 187 F.2d 150, 152, 88 USPQ 478, 481 (CCPA 1951).

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KELLY STOUFFER whose telephone number is (571)272-2668. The examiner can normally be reached on Monday - Thursday 7:00-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Meeks can be reached on (571) 272-1423. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Kelly Stouffer
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kms

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